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ABSTRACT

This qualitative study used phenomenology to investigate African American college students' perceptions of exemplary mathematics teaching practices. Data collection occurred over 12 weeks from February-April 1999. The data collection involved interviews, surveys, exemplary teacher observations, and autobiographies. Initially, participants were asked about their school experiences, with a focus on mathematics classes and teachers. Participants then completed a followup interview based on information from the survey. Participants wrote autobiographies of their experiences in mathematics education that emphasized their mathematics teachers. After finishing their autobiographies, the students completed one more interview. This paper focuses on data from two of the participating students. Results indicated that the teacher ethic of caring was critical in the mathematics education of these African American students. Teacher availability was also essential to good mathematics teaching. Another characteristic that participants appreciated was teachers freely asking students questions and encouraging students to answer, responding in a respectful and patient manner. The students also appreciated teachers' willingness to explain and to answer and ask questions. (Contains 23 references.) (SM)

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Reflections on Exemplary Mathematics Teachers by Two African American Students

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Reflections on Exemplary Mathematics Teachers by Two African American Students

ABSTRACT

This is the story of two African American college students and their perceptions of exemplary mathematics teaching practices. This qualitative study was undertaken to understand the participants' perceptions, hence phenomenology was the method of inquiry. Data were collected using surveys, autobiographies, observations, and interviews and were subsequently analyzed using inductive methods.

There were three teaching practices or characteristics of exemplary teachers across the cases in this study. They included a) high quality explanations, b) teacher availability, c) the freedom to ask and answer questions and d) a caring ethic.

Introduction

There is a growing body of available research on the academic achievement of African Americans. Several authors (Irvine, 1990; Matthews, 1984; Secada, 1992) have asserted that there is a disparity between the mathematics achievement of African Americans and European Americans. Most of the literature, however, focuses on unsuccessful African American students. This narrowing of focus tends to blame African American students for their failure instead of examining their experiences or perceptions to help alleviate the problem.

Blaming the victim for any problem is unproductive and futile. This disparity in achievement is not a problem solely for African American students or their community, but the disparity is a problem for society as a whole because of the changing population of this country. Blaming African American students for their academic failure removes responsibility from society, the schools, and the teachers of these students. A more responsible and productive line of research would be to explore successful practices for school success of African Americans in order to provide viable solutions to the discrepancies in academic achievement.

Rationale

There has been a push to reform mathematics education in this country. At the forefront of this reform movement is the National Council of Teachers of

Mathematics (NCTM, 1989, 1991). Mathematics educators strive to change the way mathematics is taught and to whom mathematics is taught. Mathematics has traditionally been offered to a small segment of the population. This segment, too often, excluded students of color and females. The changing demographics of the school aged population and the world wide need for technology gives impetus to this reform effort.

While we, in the mathematics community, attempt to transform the teaching of mathematics and make it available to every student, we must learn what methodologies work with the burgeoning mathematics student population. We must be careful that we do not make the mistakes of the past researchers and assume that the methodologies that work with one population automatically extend themselves to work with other populations (Grant & Sleeter, 1986). We must not assume that we know what is best for these students; we must let these students speak for themselves (Zinn, 1979). These concerns, regarding the reformation of mathematics education, guided this study.

Inextricably included in any reform movement involving education are classroom teachers (Hopkins & Stern, 1996). As we attempt to increase the diversity of students taking mathematics we must address exemplary teacher practices. Thus, to facilitate changes in the way mathematics is taught and to whom it is taught, teachers must be resolutely involved in the process. The primary goal of this study is to garner information about the perceptions of African American students regarding exemplary mathematics teaching practices.

In order to reform the mathematics education of African Americans, a

knowledge base about African American students' development and socialization must be formed. Murrell (1994) attributed the current lack of knowledge to the media and the fact that teacher education programs do not draw their pedagogical expertise from the culture, language, and history of African Americans. The theoretical base must include how these students analyze and synthesize their experiences with the curriculum and how they position themselves in the classroom. While there is a growing body of knowledge on the achievement of African Americans, there are scant numbers of research studies where the perceptions or experiences of African American students have been studied. Thus, this research, using a qualitative methodology, adds to the available mathematics education literature on African American students' mathematics achievement.

Theoretical Perspective of the Problem

Critical theorists believe that the structure and inequities of American public schools are not accidental (McCarthy & Apple, 1988). The barriers that African Americans and other children of color encounter are purposeful, deliberate, and meant to maintain the existing social structure. Critical theorists question the meritocratic ideas of schooling for all students of color, including African Americans, females, and lower socioeconomic students.

Critical theory, in the context of education, is based on cultural or economic reproduction (Giroux, 1983). In the last decades critical theorists have concentrated on economic reproduction and the work of Bowles and Gintis (1976). These authors asserted that schools are hierarchically structured places.

Their patterns of values, norms, and skills mirror the social dynamics necessary for maintaining our capitalist economy. As a result, schools mirror the social division of labor and the class structure that is evident in American society. These lessons are not overtly taught. They are, however, an integral part of the "hidden curriculum." The term hidden curriculum "refers to those classroom social relations that embody specific messages which legitimize the particular views of work, authority, social rules, and values that sustain capitalist logic and rationality, particularly as manifested in the work place" (Giroux, 1983, p. 263). I believe that in the mathematics classroom part of the hidden curriculum is the tacit understanding that this is the domain of White males. Females and students of color do not really belong and are subsequently expected not to do well. When they do perform well, their performance is viewed as an anomaly.

Closely related to the economic reproduction model is the cultural reproduction model. As its name implies, this area of critical theory is concerned with how capitalist societies reproduce themselves. A major tenet of this theory is that schools link culture, class, and domination. Cultural reproductionists argue that schools simply mimic the dominant society. They contend that schools are relatively autonomous and only indirectly influenced by powerful political and economic institutions. Schools do not actively support the dominant class by the oppression of others. However, students whose culture and knowledge are valued by the dominant class are deemed successful in schools (Bourdieu & Passeron, 1977).

These ideas of cultural and economic reproduction have profound

implications for African Americans. The political and economic forces in schools as described by critical theorists are road blocks to African Americans' success with school in general and mathematics in particular. Educators who are aware of the discrepancies in achievement and who are committed to eliminating these discrepancies must be ever vigilant of the hidden curriculum. They must link theoretical research to practice by real people in real institutions (McCarthy & Apple, 1988).

Understanding the Teacher's Role

There is widespread consensus on the part of mathematics educators to reform the teaching and learning of mathematics for all students. However, special attention has been given to women and students of color who have historically been underrepresented in the mathematics classroom and in careers involving science and technology (NCTM, 1989, 1991; National Research Council, 1989, 1990). Crucial to this, and any proposed, reform movement is the classroom teacher. Hopkins and Stern (1996) stated, "Teachers are at the heart of educational improvement. Any benefits that accrue to students as a result of educational policies require the enabling action of teachers" (p. 501). In order for teachers to make the necessary changes in pedagogy, teachers will have to rethink their own practices, construct new classroom roles and expectations about their students' outcomes, and teach in ways they have never taught before (Darling-Hammond & McLaughlin, 1995). I, too, believe that teachers are crucial to any proposed reforms in education and in order to initiate the reforms they will have to change their teaching methods. This changing of teaching methods

would have implications for teacher education programs. Thus, this study may have implications for preparing teachers for taking an active role in improving the mathematics education of African American students.

I conducted a qualitative study with six successful African American students at a southern public university. I hoped to understand the characteristics and teaching practices of exemplary mathematics teachers from these students' perspectives. Additionally, I wanted to know how exemplary math teachers helped these students succeed in mathematics.

Data Collecting and Methodology

This study was part of my requirements for the completion of a doctoral degree. The selection of participants in this study was based on a criterion sampling. All the participants were African Americans who had completed the Calculus I, II, and III courses in college. Since completion of calculus is prerequisite for continuing in upper level math courses, I initially recruited seven participants from upper level mathematics courses. Of the six participants that completed the study two were female and four were male. I orally recruited participants from junior and senior level mathematics classes. Each participant was asked to name an exemplary mathematics professor and asked to sign a consent form. After signing the consent form and naming an exemplary professor, the participants were given an initial survey to begin the study. The participants received a small remuneration for completing the study.

Data for the study were primarily collected over a period of 12 weeks

beginning in February of 1999 and continuing until April of the same year. The data included interviews, surveys, exemplary teacher observations, and autobiographies. Initially the participants were queried about their school experiences, specifically their mathematical classes and teachers. The participants then completed a follow-up interview based on information obtained from the survey. Interview protocol questions were used during this first interview. At this juncture, the participants were asked to write an autobiography of their experiences in mathematics education with particular emphasis placed on their mathematics teachers. After completion of the autobiographies, another interview was conducted to gather more information. After this interview, a member check was conducted whereby the transcribed interviews and documents were reviewed with each participant.

In order to condense my dissertation for this article, two of the six participants were chosen. I chose them because they were rich sources of information and willing participants.

DATA ANALYSIS

The Case of Byron

Byron was the youngest child in a family of five boys. His mother was a retired elementary school teacher and his father was deceased. Byron was from a large city in Alabama, where he was enrolled in that city's public school system. Byron attended the neighborhood middle school, which had a pre-dominantly African American student body. The magnet high school that Byron attended

was one half African American and one half European American. In high school, he enrolled in three mathematics courses: Algebra 1, geometry, and trigonometry. After high school, Byron matriculated at the University of Alabama. Here, he enrolled in Calculus I, II, and III, Differential Equations I, linear algebra, and advanced calculus. At the time of this study he was enrolled in the theory of probability.

Byron had definite opinions about his exemplary teachers and no difficulty expressing those opinions. When he talked about bad teachers he was tactful and polite. Byron attributed their difficulties to a failure in their understanding of the learning process. He was in the advanced track in high school. He had an excellent memory and could even remember the difficulties he had learning mathematics in elementary school.

Exemplary Mathematics Teachers' Characteristics and Teaching Practices

The personality traits that Byron seemed to admire in his exemplary mathematics teachers were enthusiasm, humor, and the ability to smile. Byron said:

> My very best math teachers were different people with different social, ethnic, and financial backgrounds. Some came from very humble beginnings and others were more privileged. However, each one of them shared a legitimate love of teaching. Each one brought to class with them humor and enthusiasm. (Autobiography, 3-14-99)

He said of his three favorite math teachers, " I could always expect a smile with my favorite math teachers. They were always happy to help with problems. When working with them, humor was always present with a joke or a cheerful anecdote or some story about their educational experience" (Initial survey, 2-21-

99).

Byron had very fond memories of his high school trigonometry teacher, Mr. Hill. He talked about his sense of humor, his smile and his warm personality. He also told how everyone referred to him as Reverend Hill. Mr. Hill called all of his students brother or sister and his lectures resonated like sermons. Mr. Hill had many sayings that he repeatedly told. According to Byron, if you asked anybody about Mr. Hill a smile would automatically come to that person's face before speaking. When I asked Byron about exemplary high school teachers, he talked about Mr. Hill:

> He taught me in high school and he was approachable, very friendly, always smiling and always quoting—always giving just really colorful examples of ah real life examples of what we were studying. And then when he was teaching he'd take time—like let's say he was writing something on the board that was pretty lengthy, like the time he was writing that's when he would go into his little jokes or anecdotes and it was just always a pleasant experience to be in class with him. Because you didn't get bored; it was impossible to get bored or fall asleep in his class. Hum, hum, [he had] a lot of volume in his voice; he spoke loud, he was big man and he could project very well too. So ah, he'd keep you captivated there. (Interview 1, 2-24-99)

In addition to his exemplary teachers' personalities, Byron spoke about his perceptions of exemplary mathematics teaching practices. He valued clear explanations and working numerous, pertinent examples. Byron said his best teachers, "could present the material in the examples so that anybody could understand" (Interview 1, 2-24-99). When asked about one of his best mathematics teachers Byron mentioned Dr. Hope and said, "He'd present theory and then always have a number of examples to give to us, ah to see application of things. Because sometimes it's just easier to see something applied and it

would make more sense" (Interview 1, 2-24-99).

Byron valued his exemplary mathematics teachers' availability and willingness to answer questions. Byron again talked of his best high school math teachers, especially Mr. Hill. According to Byron, Mr. Hill would come to school early and he was able to get some one-on-one time with him. He recounted one day where Mr. Hill helped him with simplification of polynomials, which had given him trouble in class the day before. Byron reported,

> And it was just the two of us and we were sitting there working; and that was just kind of a real meaningful point; just because it was just the two of us--outside of class, nobody else there, no interruptions. (Interview 1, 2-24-99)

Byron told about his geometry teacher who also came in early. One day he was having trouble with concepts that other students had already grasped. Byron knew this teacher was busy with many other activities and was reluctant to disturb her. He was outside her room struggling with a proof and she invited him in and helped him understand a particular geometric proof. Byron said,

> I can't remember, but it was something really, really basic. It was something very simple that I just wasn't grasping. We broke the whole problem down and that one problem helped me with a whole lot of others too that were related. (Interview 2, 3-23-99)

During our first interview, Byron also emphasized exemplary mathematics teachers' willingness to answer questions as essential for him to learn mathematics. He said,

> Um, well just, I think, the willingness to answer any question I have regardless of whether or not you think--cause I mean true enough there are things I might be rusty on because I haven't looked at it in a while or something very basic that I just forgot. Cause there are times when I would use things, just using them, and been able to use them to solve problems, or whatever, but not remember what it was called or where I

> learned it, but I just would use it. And then just being able to say "I'm sorry, I forgot what that term means." (Interview 1, 2-24-99)

Interactions with Teachers and Peers

Byron's feelings about his teachers were very positive overall. He stated that he had exceptional high school and college mathematics teachers. He elaborated on his bad teachers,

> Well, I won't say that, I won't say anything like I hate them or I dislike them. Not necessarily them; it's just the way that they taught. Cause you have those people that are not quite as engaging as other people. And you have a question or something that seems obvious to them, yet they tend to think that it should be obvious to everybody, you know. Cause I've had, I've had experiences where I've actually heard, you know, people, you know, I've had teachers that would actually say things along the lines like, "What are you stupid?". (Interview 1, 2-24-99)

When I asked Byron if he fit in with his peers in math classes he indicated,

> I usually didn't feel like out of place. There really weren't like any cliques, groups that you have sometimes.... You know, those people that just do well in math and all that kind of thing, and only stick with those people that can get those things right off. I never really saw anything like that. In every class I've had everybody--regardless of ah, ah, performance level in the class; was always helpful, willing to study. If you didn't understand something and they understood it, you know, we'd help each other to get the concept together. Ah, so yeah, I always felt like I fit in there, never felt out of place. (Interview 1, 2-24-99)

The Case of Jim

Jim was from a small town in northern Alabama near the Georgia border. During his elementary years he went to the county schools and in middle school he transferred to the city schools. Jim mentioned that in the county schools one was usually passed along; however, in the city schools, the expectations were higher. In high school, Jim enrolled in general mathematics, pre-algebra, and

Algebra I. He did not take math his senior year because he was in cooperative education, where students went to school in the morning and to work in the afternoons.

Jim went to a junior college in his home town immediately after high school. He reported that he was not ready for college and withdrew before the first semester ended. After this experience, he worked at odd jobs in Mississippi. He eventually enrolled in a community college there and took several mathematics courses. They included intermediate algebra, trigonometry, and Calculus I, II, and III. He subsequently transferred to the University of Alabama and at the time of this study was enrolled in Differential Equations I.

Jim was a non-traditional student; he was 29-years-old. His family was large and closely knit. He was fourth from the oldest and seemed especially close to one of his older brothers and an older sister. He frequently talked about them and their influence on his life.

Exemplary Mathematics Teachers' Characteristics and Teaching Practices

Jim valued teachers who showed concern, were well-prepared, spent time outside of classes, exhibited patience, and were not intimidating. He spoke fondly of his Algebra I teacher in high school, Mrs. Watt.

> I guess for the most part she was a concerned teacher, you know. She always showed concern, you know. It was always enough time for her to help you, you know. Ah, she wasn't intimidating--most teachers sometimes they come off a little intimidating by you asking questions; they kind of give a sharp sigh, like, you should have knew [sic] that, or something like that, you know. (Interview 1, 3-19-99)

In his first interview and in his autobiography, Jim said he admired Mrs. Watt because she did not have student pets and treated everyone equally. He

believed, however, that she was aware that students had individual needs and sometimes gave these students special attention.

Jim also believed Mrs. Watt's teaching practices helped him learn mathematics. She always made things clear by explaining in detail the procedures to follow. The pace in her class was slow enough that Jim could not only ponder what Mrs. Watt taught, but he could also remember it. Jim explained how she helped when he had difficulty:

> Hum, Mrs. Watt, I mean she was like, first of all she'd put her hands on your shoulder and, you know, kind of softly; you barely knew her hand was there. And you know, that made you kind of feel kind of comfortable, you know. Cause, like, she's going to help me. . . And ah,. . . she kind of went through and, kind of, let you kind of expiain what you knew about the problem and that way she had some place to pick up from. You know, to start in you know, and she might even go back, go through, even go over what you just told her and, you know, ah, she did a real good job of explaining; she took her time. I mean it wasn't like you do this right here and this right here, you know it was more like, okay, after you do this right here, you do this right here, you know. (Interview 1, 3-19-99).

Jim had a very special relationship with Mrs. Watt. She had a soft voice and a gentle touch. Jim said that her gentle nature meant a lot to him because he was the lone person of color in the classroom. "If she'd have put me on the spot in there then you know, I'm not only looking, I'm not only sitting there like with my color I am sitting there thinking what are people thinking about me" (Interview 1, 3-19-99). In addition to her gentle nature, Mrs. Watt made Jim feel comfortable in her class by acknowledging that he was a good student. In lieu of his final exam in her course, Mrs. Watt told him to write an essay outlining his plans and goals after high school.

After high school, Jim's next memorable teacher was Mrs. Gray at a

community college in Mississippi. Mrs. Gray was his college algebra teacher. Jim noted during our first interview that she was his first African American teacher. Jim described Mrs. Gray as somewhat like a mother. He said, "She would get on to you like you were her child" (Autobiography, 4-12-99). He wrote that she admonished him for talking with females in class and reminded him that talking should take place after class. Mrs. Gray always started her class with a cheerful good morning and a brief conversation about non-mathematical topics. This, according to Jim, gave her class had a good learning atmosphere.

At the same community college in Mississippi, Jim had a Calculus II and III teacher, Mr. Higgins that he admired. He described him as well prepared and thought-provoking. He would go down the rows and ask students questions. Mr. Higgins would say "Jim what is the derivative of such and such and, ah, Bryan you be thinking about it, in case he gets it wrong" (Interview 1, 3-19-99). Mr. Higgins was able to do this because the first day of class he memorized all the students' names so that he could call on them in class. Jim noted that this was how he involved his students in his mathematics class.

Jim admitted that Mr. Higgins' class was fast-paced, and he did not take much time to explain concepts in class. However, when students went to see Mr. Higgins in the help lab, he would take his time and explain it thoroughly. When Jim was in class with Mr. Higgins and did not remember something from a previous class, Mr. Higgins would encourage him to memorize it because he was going to need it for another topic in the class. He said of Mr. Higgins, " He kind of made you want to study" (Interview 1, 3-19-99).

Jim seemed to value the relationships and methodologies of his exemplary mathematics teachers. The things that he mentioned most often were his interactions with or perceptions of these teachers. Some of his exemplary teachers were kind and accepting of him in a difficult situation, others inspired him to learn by their involvement with the students or their preparedness for class.

Interactions with Teachers and Peers

Jim usually interacted well with other students. The only time he mentioned feeling awkward was when he transferred from the county schools to the city schools. In the city schools he noted that he was the only African American in some of his classes. This contributed to his discomfort in the class and made him reluctant to ask for a seat close to the front of the room, which would have made it easier for him to see the blackboard. Several times during this study he mentioned how Mrs. Watt made him feel special by acknowledging that he was a superior student. Jim said that when he was in high school and the other students would ask about his test grades, they would inevitably respond "you are smart."

> In community college Jim studied by himself until he got to calculus where he studied with the engineering students. Even though some in the group talked about other things a lot, it helped him understand the subject. Jim thought that if he was able to help another student it meant he had studied enough and already understood the concept. Jim also formed study groups at the University. He said, "Yeah I'm forming them. I kind of get

numbers and stuff, not all, not all of them are good. I have to pull some—drop some because they talk" (Interview 1, 3-19-99).

While these participants may have used slightly different words, there were four teaching practices or characteristics of exemplary teachers across both cases in this study. They were a) high quality explanations, b) teacher availability, c) the freedom to ask and answer questions and d) a caring ethic.

DATA INTERPRETATIONS, CONCLUSIONS, AND IMPLICATIONS

Data Interpretations

The importance of the caring ethic has been documented in the literature on effective teaching practices from students' perceptions (McCabe, 1995), effective teaching practices for African American students (Ladson-Billings, 1994; Lipman, 1994), and effective teaching practices for at-risk students (Peterson et al., 1991). In the mathematics classroom, the caring relationship is normally between students and teachers. The data in this study supported the caring ethic as critical in the mathematics education of African American students.

These two participants expressly stated that they valued a caring ethic in their exemplary mathematics teachers. These participants wanted their teachers to care about whether or not they succeeded in math class; they identified teacher availability, clear explanations, and the ability to answer and ask and questions as exemplary teaching practices. Based on the findings from this

study, I assert that these practices can be interwoven across the central theme of a caring ethic and that these three issues are themselves interwoven.

The two participants in this study named teacher availability as essential to good mathematics teaching. These participants wanted their mathematics teachers to be available at various times during the day, taking into consideration their students' schedules. But for these students, availability was more than simple accessibility. The good mathematics teachers named by these participants spent time with their students helping them overcome their difficulties with mathematics by giving clear and concise explanations. They provided additional examples to reinforce concepts and frequently asked leading questions of the students until these concepts became clear. These behaviors ultimately indicated to the participants that the teachers cared about them. Many of these participants wanted their good mathematics teachers to continue to be available even if the students were not currently enrolled in their classes. Toliver (1993), in her research regarding successful practices for African American students, also supported the idea that teacher availability was closely tied to students' perceptions that exemplary teachers cared about them. She deemed the caring ethic crucial to good mathematics teaching.

Another characteristic that the participants appreciated in good mathematics teachers was that they freely asked questions of their students, encouraged students to ask questions, and responded to questions in a respectful and patient manner. This "give and take" between students and teachers is referred to as classroom discourse and is strongly recommended by

the NCTM (1989) as an essential element of good mathematics teaching. I maintain that classroom discourse is related to the caring ethic. A classroom environment where students can freely ask questions of their teachers and respond to their teachers' questions is an indication that teachers believe their students have something worthwhile to say, that their opinion is valued in the mathematics classroom. Ladson-Billings (1994) highly recommended the use of dialogue between teachers and students in the classroom. She stated, "The give and take of dialogue makes struggling together for meaning a powerful experience in self-definition and self-discovery" (p. 155). Classroom discourse assumes that students are capable of learning and they have something valuable to add to the classroom.

Integrally related to classroom discourse are clear explanations. Land (1980) found a correlation between college mathematics teachers' use of specific language and their ability to convey multiple solutions to their students. My participants' responses regarding their exemplary mathematics teachers' ability to explain and their willingness to answer and ask questions led to my assertion that classroom discourse and clear explanations are interrelated. One of the primary ways these participants indicated that their teachers helped them learn mathematical concepts was by giving clear explanations. Clear explanations are indicative of a caring ethic because the teacher has taken time to identify students' needs and intuitively assess the way that their students learn. While all of the participants in this study wanted clear explanations, the explanations took on different forms for different participants. Byron wanted his explanations to be

a series of probing questions, while Jim valued sufficient wait time. Clear explanations as a characteristic of effective teachers is supported in the literature (Cohen & Seaman, 1997). In their study, Cohen and Seaman questioned administrators and classroom teachers to ascertain effective teacher practices.

Conclusions and Implications

The findings in this study emphasize the caring ethic for African American students. I maintain that all students need the perception of caring, because having a sense that someone cares makes students feel that they belong. This in turn makes them want to learn. However, a caring ethic is essential for African American students who face the same problems in the mathematics classroom as other students, but with more exaggerated effects because of racism in this country.

Researchers have separately supported teacher availability, clear explanations, and classroom discourse as effective teaching practices (Cohen & Seaman, 1997; Ladson-Billings, 1994; Land 1985; Toliver, 1993). I purport that on the basis of this study, that these three characteristics are not only effective teaching practices; they are essential ingredients to the concept of a caring ethic for the exemplary mathematics teachers of African American students.

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